LA-13606-PR Progress Report
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Physics Division Progress Report

January 1, 1997—December 31, 1998

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Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545

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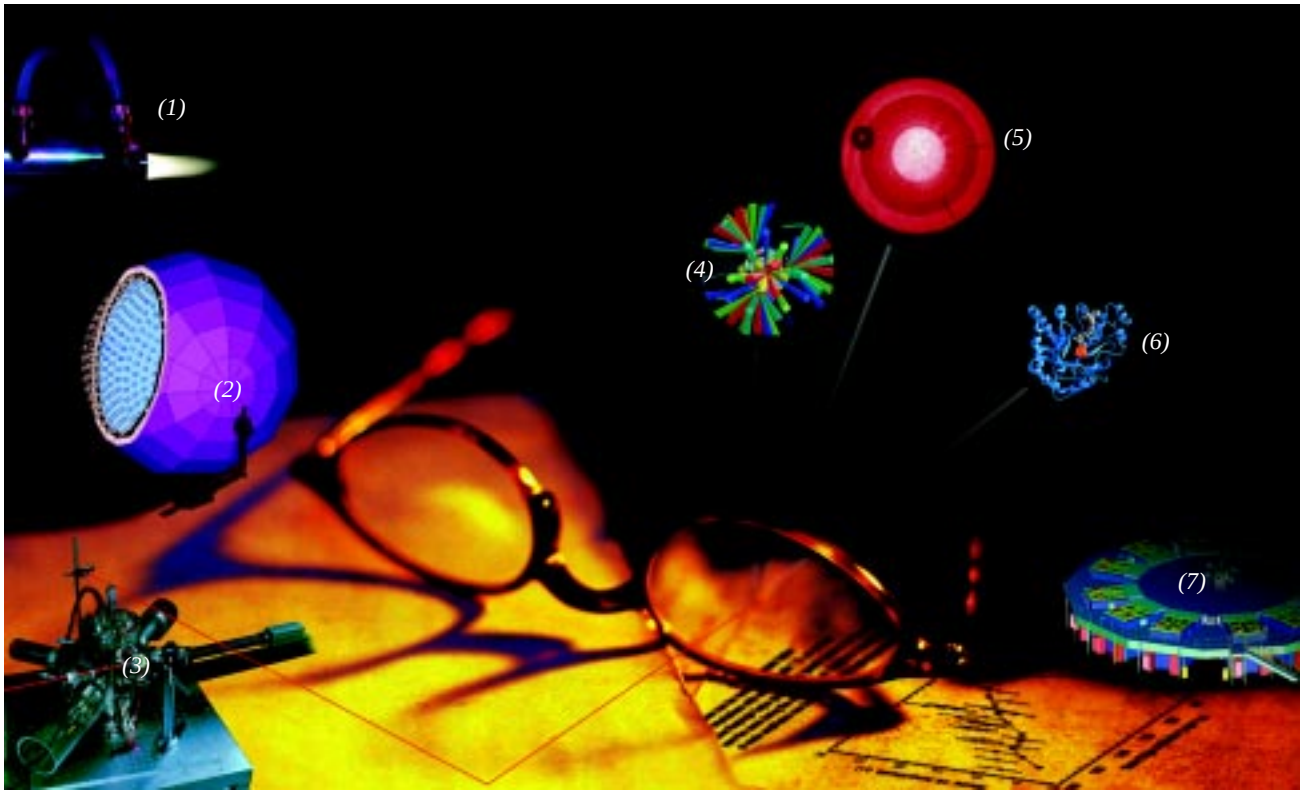

On the cover:

This cover design illustrates the wide and diverse range of projects that we pursue in the Physics Division:

(1) We developed the atmospheric pressure plasma jet, a novel tool for removing surface contaminants from target objects. Applications include neutralizing chemical and biological contaminants and removing graffiti.

(2) In collaboration with Fermilab, our Booster Neutrino Experiment (BooNE) will use an oil-filled sphere lined with 1,220 phototubes to observe the tiny light flashes that accompany neutrino oscillations. Such oscillations would mean that neutrinos have mass, and would change the way we view the composition of the universe.

(3) We are developing a technique for quantum computation using laser manipulation of cold, trapped atoms. Using an apparatus like this, we have succeeded in trapping calcium ions that may serve as the basic quantum-mechanical bits.

(4) We are exploring various designs for radiation cases, or hohlraums, that might be used to achieve thermonuclear ignition at the National Ignition Facility. This image shows a spherical hohlraum with tetrahedral symmetry, which will allow implosion experiments at NIF-relevant energies. The graph on the page alludes to experiments exploring hydrodynamic instabilities in cylindrical hohlraums.

(5) To refine the models used to calculate weapons performance, we study imploding liners at the Pegasus Pulsed-Power Facility. This radiograph shows a liner 3.38 microseconds after implosion. Visible are material that has broken free from the target during the implosion, and jets of aluminum seeded by grooves machined on the target's surface.

(6) We are collaborating with the Life Sciences Division on the Structural Genome Project, a nationwide effort to achieve a comprehensive understanding of three-dimensional protein structures. Protein cartoons like this allow researchers to visualize protein structures and their functions, a major step toward a complete understanding of the machinery of life.

(7) The future Atlas Facility will provide 23-MJ of pulsed-power for science-based stockpile stewardship and basic scientific research. The Atlas capacitor bank, shown, will be housed in 12 oil tanks arranged around a central target chamber. Atlas is expected to generate its first pulse in 2001.

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Abstract

This issue of the Physics Division Progress Report describes our progress and achievements in applied and basic science during calendar years 1997 and 1998. The report covers the activities of the five Physics Division groups, which represent the main areas in which we serve Los Alamos National Laboratory and the nation: Biophysics, Hydrodynamic and X-Ray Physics, Neutron Science and Technology, Plasma Physics, and Subatomic Physics. This report includes a message from the Physics Division director, general information about the mission and organization of the Division, descriptions of the activities of each of our groups, highlights of major research efforts throughout the Division, descriptions of the individual projects we support, our staffing and funding data for the subject years, and a list of our publications and conference presentations.

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